

REMARKS

Claims 1, 4, 13 and 32 are amended. Claim 10 is canceled. New claims 62-68 are added. Claims 1-9, 11-32 and 62-68 remain in the application. Reconsideration of the application in view of the amendments and the remarks to follow is requested.

The drawings are amended for correction as shown. No new matter is added as Fig. 3, as amended, is clearly described in the originally-filed application at, for example, page 9, lines 3-12.

Claims 5-7 and 9 would be allowable if rewritten to include limitations of the base claim. New claims 65-68 are such rewritten claims, and therefore, are allowable.

Claims 4, 5-7, 9, 20, 24, 25-26 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1-4, 10 and 12 stand rejected under 35 U.S.C. §102(e) as being anticipated by Sakai et al. (6,274,457). Claims 8, 13-19, and 21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sakai and further in view of Tsai (6, 258,688). Claim 11 stands ejected under 35 U.S.C. §103(a) as being unpatentable over Sakai and further in view of Stolmeijer (5,874,317). Claims 22-24, 27-30 and 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Noguchi (5,969,393) view of Sakai. Claim 31 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Noguchi and Sakai and Stolmeijer.

Regarding the objections against claims 12, 14-15, 17, 23 and 27 for informalities, the Examiner states that the article "a" used to introduce, for example, the phrase "first isolation trench portion" in lines 1-2 of the respective claims should be amended to recite "said" as if the phrases had proper antecedent basis in the preamble of each claim. However, there is no antecedent basis for each objected to phrase, and therefore, the claims as written are proper. Applicant respectfully requests withdrawal of such objections in the next office action.

Regarding the objection against claims 32 for informality, the claim is amended to obviate the objection.

Regarding the §112, second paragraph, rejection against claim 4, the Examiner suggested that it is unclear whether the semiconductor comprises silicon. Claim 4 is amended to explicitly recite the semiconductor comprises silicon, and therefore, this rejection is obviated.

Regarding the §112, second paragraph, rejection against claim 5, the Examiner states the specification discloses a photoresist layer having an opening disposed on top of the silicon nitride layer but never discloses a masking layer having an opening disposed on top of the silicon nitride layer. Respectfully, one skilled in the art understands that a photoresist layer is appropriately described as a masking layer. Accordingly, the specification discloses the recited limitation of claim 5, and therefore, the rejection is inappropriate and should be withdrawn.

Regarding the §112, second paragraph, rejection against claims 9 and 24, such claims are rejected for the same reasoning provided for the §112 rejection

against claim 5 discussed above, and therefore, for the same reasons, the rejection against claims 9 and 24 are inappropriate and should be withdrawn.

Regarding the §112, second paragraph, rejection against claims 20 and 25, the Examiner is respectfully reminded that MPEP §2173.02 (8th Edition) states the essential inquiry pertaining to a §112, second paragraph requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:

- (A) the content of the particular application disclosure;
- (B) the teachings of the prior art; and
- (C) the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

In reviewing a claim for compliance with 35 U.S.C. §112, second paragraph, the Examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. §112, second paragraph.

(citations omitted) MPEP §2173.02 (8th Edition). Applicant submits that the claims are clear and definite on their face. Moreover, one of ordinary skill in the art with the opportunity to consider and review the contents of the application disclosure pursuant to the above authority would clearly understand the language

of the claims. "A fundamental principle contained in 35 U.S.C. 112, second paragraph is that applicants are their own lexicographers [and] [t]hey can define in the claims what they regard as their invention essentially in whatever terms they choose...." MPEP §2173.01 (8th Edition). Pursuant to this authority, the §112 rejection against claims 20 and 25 are inappropriate and must be withdrawn.

Moreover, since no other rejection is presented against claims 20 and 25, such claims are allowable. Applicant respectfully requests allowance of claims 20 and 25 in the next office action.

Regarding the anticipation rejection against claim 1 based on Sakai, such claim is amended to include the limitations of claim 10, which also is rejected as allegedly being anticipated by Sakai. As amended, claim 1 recites forming a first isolation trench portion comprises forming the first isolation trench portion having a first depth of between five and fifty percent of a total trench depth. The Examiner states Sakai teaches a first depth of about 3.75 to 37.5 percent of a total trench depth at col. 9, Ins. 42-63 of Sakai (pg. 7 of paper no. 13). Respectfully, the Examiner is mistaken. Sakai teaches respective dimension **ranges** for a first trench 11a and a final trench structure 11, but no relationship (such as percentage relationship) between the respective ranges. That is, Sakai teaches a first trench 11a has a depth of 30 nm-about 300 nm (col. 9, Ins. 41-44; Figs. 8a-b) and a final trench structure 11 has a depth of 50 nm-about 500 nm (col. 9, Ins. 60-63; Figs. 8c-d). Sakai does not teach a specific

depth dimension for either trench 11a or 11 wherein a relationship relative the undisclosed specific depth dimension can be determined. That is, the Examiner can not arbitrarily (antithesis to a teaching) pick one depth dimension out of one depth range taught by Sakai and then compare it to the other depth range for a percentage comparison. Accordingly, in no fair or reasonable interpretation does Sakai teach or suggest forming a first isolation trench portion comprises forming the first isolation trench portion having a first depth of between five and fifty percent of a total trench depth as recited in claim 1. Sakai fails to teach or suggest, singularly or in any combination, a positively recited limitation of claim 1, and therefore, claim 1 is allowable.

Claims 2-9 and 11-12 depend from independent claim 1, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

Regarding the obviousness rejections against claim 13 based on Tsai singularly, and on the combination of Sakai and Tsai, such claim recites forming a mask on the surface, the mask including an opening and sidewalls and etching the silicon surface using gases including CF_4 and CHF_3 in a ratio of $CF_4/CHF_3 = 0.11$ to 0.67 to form a first isolation trench portion, wherein the etching forms the opening and sidewalls in the mask. That is, the mask and silicon surface are etched in the same step. Tsai teaches forming an opening in a mask 18 over a substrate 10, and in a **separate step**, forming a trench 22 in substrate 10 (col. 5, Ins. 1-45; Figs. 1-3). Sakai teaches forming an opening in a oxide

5 and nitride film 6 over a substrate 1, and in a **separate step**, forming a trench in substrate 1 (Figs. 2a-f; 6a-b; 9a-f) (note: Figs. 8a-d do not teach any relationship between the timing of forming an opening through oxide 5 and nitride 6 relative forming an opening in substrate 1; see col. 9, lns.30-65). Since Tsai and Sakai, singularly, fail to teach or suggest etching the mask and silicon surface in the same step, it is inconceivable that any combination of the two references could teach such limitation. Consequently, Tsai and Sakai, singularly or in any combination, fail to teach or suggest a positively recited limitation of claim 13, and therefore, for at least this reason, claim 13 is allowable.

Moreover, the Examiner states Sakai does not teach using gases including CF_4 and CHF_3 to etch a silicon substrate and relies on Tsai to allegedly teach such limitation (pg. 10 of paper no. 13). However, Tsai fails to teach or suggest any type of etching for mask 18, much less any type of gas composition for same. Accordingly, in no fair or reasonable interpretation does Sakai and Tsai, singularly or in any combination, teach or suggest the etching [using gases including CF_4 and CHF_3] forms the opening and sidewalls in the mask as recited in claim 13. Consequently, Tsai and Sakai, singularly or in any combination, fail to teach or suggest another positively recited limitation of claim 13, and therefore, for this additional reason, claim 13 is allowable.

Claims 14-21 depend from independent claim 13, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

Regarding the obviousness rejection against claim 22 based on Noguchi and Sakai, such claim recites forming a mask on the surface, the mask including first and second openings corresponding to the first and second isolation trenches; forming a first isolation trench portion in each of the first and second openings, each first isolation trench portion having a first depth and having a first sidewall intersecting a surface of the semiconductor at a first angle; and forming a second isolation trench portion within and extending below each of the first isolation trench portions, the second isolation trench portions having a second depth and including a second sidewall intersecting a respective one of the first sidewalls at an angle with respect to the surface that is greater than the first angle.

The Examiner correctly states that the Noguchi fails to teach any of these limitations and relies on Sakai to supply the deficiency in teachings (pgs. 13-14 of paper no. 13). The Examiner states it would be obvious to modify the Noguchi invention by incorporating the trench-forming method of Sakai (pg. 14 of paper no. 13). That is, the Examiner is suggesting substituting the trenches of the Noguchi invention with the Sakai trenches. However, the entire disclosure of Noguchi is directed to forming **specifically designed** trenches to overcome problems with conventional trenches (background), for example, three insulating layers wherein relative thicknesses of the insulating layers are controlled (abstract; Figs. illustrating different embodiments: 2b, 3c-3f, 4a0b, 7a-c). Accordingly, modifying the Noguchi invention with the Sakai trenches would render the Noguchi invention being modified unsatisfactory for its intended

purpose contrary to well established Federal Circuit law and MPEP authority. The Examiner is respectfully reminded that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. MPEP §2143.01 (8th Edition) *citing to In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Accordingly, pursuant to this authority, such modification of the Noguchi invention with the Sakai trenches is improper, and therefore, the obviousness rejection based on the combination is improper and must be withdrawn. For at least reason, claim 22 is allowable.

Moreover, the Examiner is respectfully reminded that if the proposed modification or combination of the prior art would change the principal of operation in the prior art invention being modified, then the teachings of the reference are not sufficient to render the claims *prima facie* obvious. MPEP §2143.01 (8th Edition) *citing to In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The court in *In re Ratti* reversed a rejection holding the “suggested combination of references would require substantial reconstruction and redesign of elements shown in the [primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate” 270 F.2d at 813, 123 USPQ at 352. No fair or reasonable argument can be made that modifying the Noguchi invention with the Sakai trenches would not require **substantial reconstruction and redesign** of elements shown in the Noguchi reference as well as a change in the basic principle under which the

Noguchi reference construction was designed to operate. Such **substantial reconstruction and redesign** is contrary to the above authority, and therefore, such modification of the Noguchi invention with the Sakai trenches is improper. For this additional reason, the obviousness rejection against claim 22 based on the combination of Noguchi and Sakai is improper and must be withdrawn. For this additional reason, claim 22 is allowable.

Claims 23-32 and 62-64 depend from independent claim 22, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.


Further, Applicant herewith submits a duplicate copy of the Information Disclosure Statement and Form PTO-1449 filed together with this application on August 31, 2000. No initialed copy of the PTO-1449 has been received back from the Examiner. To the extent that the submitted references listed on the Form PTO-1449 have not already been considered, and the Form PTO-1449 has not been initialed with a copy being returned to Applicant, such examination and initialing is requested at this time, as well as return of a copy of the initialed Form PTO-1449 to the undersigned.

This application is now believed to be in immediate condition for allowance, and action to that end is respectfully requested. If the Examiner's next anticipated action is to be anything other than a Notice of Allowance, the

undersigned respectfully requests a telephone interview prior to issuance of any such subsequent action.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Inventor Keiji Jono et al.
Assignee KMT Semiconductor, LTD and Micron Technology, Inc.
Group Art Unit 2811
Examiner Q.D. Vu
Attorney's Docket No. KM1-001
Title: Methods of Forming an Isolation Trench in a Semiconductor, Methods of Forming
an Isolation Trench in a Surface of a Silicon Wafer, Methods of Forming an Isolation
Trench-Isolated Transistor, Trench-Isolated Transistor, Trench Isolation Structures
Formed in a Semiconductor, Memory Cells and DRAMS

**VERSION WITH MARKINGS TO SHOW CHANGES MADE
ACCOMPANYING RESPONSE TO NOVEMBER 6, 2002 OFFICE ACTION**

In the Claims

The claims have been amended as follows. Underlines indicate insertions
and ~~strikeouts~~ indicate deletions.

1. (Amended) A method of forming an isolation trench in a semiconductor comprising:

forming a first isolation trench portion having a first depth and having a first sidewall intersecting a surface of the semiconductor at a first angle;

forming a second isolation trench portion within and extending below the first isolation trench portion, the second isolation trench portion having a second depth and including a second sidewall intersecting the first sidewall at an angle with respect to the surface that is greater than the first angle; and

filling the first and second isolation trench portions with dielectric material; and

wherein the forming of the first isolation trench portion comprises forming the first isolation trench portion having a first depth of between five and fifty percent of a total trench depth.

4. (Amended) The method of claim 1, wherein ~~forming an isolation trench in a~~ the semiconductor comprises ~~forming an isolation trench in~~ silicon.

13. A method of forming an isolation trench in a surface of a silicon wafer comprising:

forming a mask on the surface, the mask including an opening and sidewalls; and

etching the silicon surface using gases including CF_4 and CHF_3 in a ratio of $\text{CF}_4/\text{CHF}_3 = 0.11$ to 0.67 to form a first isolation trench portion, wherein the etching forms the opening and sidewalls in the mask.

32. The method of claim 22, wherein ~~forming a~~ the gate comprises ~~forming a gate comprising~~ polysilicon.

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